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Code: 58. Fresh Chloroform Storage Tank: C-240 / 4879

Drawings: 817733-02B2 (R19)-Sheet 2 of 2

817733-01D3 (R16)

Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
High Pressure	1. Failure of PIC 240-2 reading lower than actual.	F	Failure of nitrogen make-up / blowdown system can put 90 psig on the tank.	H	2	1	1. PSV 240-50 set at 30 psig on tank. Vents to atmosphere in tank farm.	1.0	H	4	3	
	2. Overpressure 2.5 -3 x MAWP.	VF	The diked area can contain the liquid. But chloroform can permeate through concrete if not removed in acceptable timeframe.				2. PSV 240-100 set at 22 psig on nitrogen line.	1.5				
	3. Person Present.	VF	Overpressure 2.5-3 x MAWP. Could result in fatality to person nearby. RQ Exceedance-vaporization to the air.									
	1. Failure of PIC 240-2 reading lower than actual.	F	Railcar Unloading Nitrogen pressure to storage tank	H	3	2	1. PSV 240-50 set at 30 psig on tank. Vents to atmosphere in tank farm.	1.5	H	4	3	
	2. Failure of nitrogen regulator on railcar unloading (blowing line clear after unloading).	F	The railcar unloading operation is padded with 45 psig regulated nitrogen (supplied from the 90 psig nitrogen plant header).									
	3. Failure to close the transfer valve when line is blown clear.	F	Failure of the storage tank's nitrogen make-up / blowdown system will close the tank vent valve and can put 90 psig on the storage tank.									
	4. Overpressure 2.5-3 x MAWP.	VF	The diked area can contain the liquid. But chloroform can permeate through concrete if not removed.									
	5. Person Present.	VF	Overpressure 2.5 -3x MAWP. Could result in fatality to person nearby. RQ Exceedance-vaporization to the air.									
2. Low Pressure			The PSV can relieve the inlet feed pump flow.									
3. Vacuum			No consequence.									
	1. Failure of PIC 240-2 reading higher than actual.	F	Potential to collapse the tank - Not rated for full vacuum. Tank may collapse damaging the vessel and creating a small release or crack in the vessel. Chloroform may be release to the concrete pad area to the unit sump. (Chloroform can permeate through concrete if not removed).	M	2	2	1. Vacuum Relief 3" Vared.	1.0	M	3	3	
	2. Pumping out of tank.	VF										
	3. Crack in tank during collapse.	F	Modeled as a liquid pool via ALOHA and PEAC: Vapors would not exceed IDLH at the fence line, but could result in exposures to chloroform. Liquid would drain to sump and overflow to the process sewer resulting in a chloroform release									
	4. Person present.											

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Worksheet Report
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Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
High Level	1. Failure of LI 240-3 reading lower than actual.	F	The chloroform can overflow the storage tank into the Chloroform Vent Header. The vent header Knock-Out Pot drains the liquid to the Extractor Feed Tank. The blow-down vent valve is 1" compared to the 3" filling line. The unloading pump can pressure the tank to 48 feet (32 psig). This should not open the PSV on the top of the tank.				1. Unloading pump head is less than tank MAWP. 2. PSV 240-50 set at 30 psig on tank. Vents to atmosphere in tank farm. 3. Only receive tank truck when the tank is empty (but failed LI).					
5. Low / No Level			No consequence.									
6. High Temperature			No consequence.									
7. Low Temperature			Not feasible.									
8. High Flow			No consequence.									
9. Low / No Flow			No consequence.									
10. Reverse Flow			Operational Issue.									
			No consequence.									
			Water into Fresh Chloroform Tank									
			The Fresh Chloroform Tank does not have the same water detection safeguards present on the Dry Chloroform Tank.				1. Feed chloroform to the process only from the Dry Chloroform Tank (safeguards for water detection installed).					
			Chloroform can only be added to the process through the Dry Chloroform Tank.									
			See Water Surge Tank Node; High Level									
Error in Source	1. Spotting the wrong railcar in error.	F	Not considered feasible. Yard clerk instructions to assist railroad spotter. Chloroform is top unloaded similar to the MMA railcar. But chloroform and MMA have different type of connections to prevent unloading the wrong material.	H	2	1	1. 4 eyes principle--lab analysis and unit check of analysis. 2. 4 eyes principle--railroad engineer and BCS employee spots car 3. Recommendation-- Improve labeling for railcar	1.0	H	4	3	
	2. Operators unload different railcar than provided in his instructions and is tagged on the railcar.	F	Wrong material unloaded into the storage tank					1.0				

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 817733-01D3 (R16)

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Deviation	Cause	f	Consequence	Potential Risk			Safeguards			N	Mitigated Risk			RS No.
				S	P	R					S	P	R	
			could cause a reaction that results in fatality.					unloading area. [Recommendation]						
								4. Operator Checklist instruction--Unloading SOP						
12. Error in Destination			Can only feed to the Dry Chloroform tank or to the Phosgene unit Chloroform storage tank. Operational issue. The Phosgene unit chloroform storage tank only uses chloroform for cooling/heating media.											
13. High Composition			No consequence.											
14. Low Composition			No consequence.											
15. Other than / Contamination			Water into storage tank from Water Surge tank overflow scenario.											
			See Reverse Flow.											
16. High / Low Viscosity			No consequence.											
17. High / Low pH			Fresh Chloroform only received into this tank.											
18. More agitation			No consequence.											
19. Less / No agitation			No consequence.											
20. Utility Failure			No consequence.											
21. Mechanical Failure			See Vacuum.											
	1. Gasket leak.	R	Chloroform to Groundwater-chloroform permeates concrete Chloroform liquid leaks from a sealing surface on the storage tank. The tank system is in a diked area. Per Amin Heyn (Currenta), the concrete dike, with no sealant, allows chloroform to permeate through concrete. If chloroform permeates the concrete and leaks into the ground, the chloroform can potentially get into the groundwater. It is not feasible the	H	2	1		1. Recommendation--Concrete material suitable to retain chloroform, impervious for 3 days typically. If acceptable, worth 1 pt. Update 11/4/10--PHA Team; Dike suitable to contain a spill for a short term (~3-days) based on existing concrete type and thickness (>50 mm).	1.0	H	4	3		201

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Mode: 58. Fresh Chloroform Storage Tank: C-240 / 4879

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7733-01D3 (R16)

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Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
			amount leaked from a gasket leak could have an impact on drinking water.				[PHA Update] 2. 4 eyes principle - Multiple (different operators) performing shiftly visual rounds for leaks. <i>David Kahn - Jan 17 2011 - SOP Section XV.</i> 3. Concrete dike designed to contain contents of tank. 4. Weekly dike inspection performed by operator.	1.0				
22. Corrosion / Erosion	1. Liquid Backflow from Chloroform Vent Header.	R	Could lead to corrosion of the steel from acidic vent header. Leak from the storage tank could cause chloroform inhalation to person nearby. Could result in recordable injury.	L	2	3	1. PwM plan to inspect vessel every 10 years.	1.0	L	3	3	
23. Static Electricity			No consequence.									
24. Startup / Shutdown Hazards			No consequence.									
25. Maintenance Hazards			No consequence.									
26. Emergency Situation Hazards			No consequence.									
27. Adjacent Equipment Hazards			No consequence.									
28. Sampling Hazards			Sampling at this point is very rare. An evacuation box is installed for this sample. No consequence.				1. Sampling procedure according SOP					
29. Personal Protection Hazards			No consequence.									

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Code: 59. Fresh Chloroform Tank Transfer Pump G-A241
Drawings: 817733-02B2 (R19)-Sheet 2 of 2

Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
High Pressure			See low/no flow.									
Low Pressure			No consequence.									
Vacuum			No consequence.									
High Level			No consequence.									
5. Low / No Level			See low/no flow.									
6. High Temperature			See low/no flow.									
7. Low Temperature			No consequence.									
8. High Flow			No consequence.									
9. Low / No Flow	1. Blocked in discharge valve and suction valve (in error).	F	Blocked in pump creates high pressure due to thermal expansion. Pump develops leak. The contained volume of chloroform will be released (<50 pounds).				1. Pump is in diked area.					
	2. Pump running	-	Recordable injury to person nearby is not likely because the chloroform is cold. Any material sprayed onto a person can be easily washed away in the safety shower.				2. Pump checks logged once per shift.					
	3. person present	VF					3. LOTO procedure					
	1. Blocked in pump discharge.	F	No consequence.				1. Pump is in diked area.					
	2. Person present	VF	Blocked in discharge causes the mag- pump temperature to rise due to loss of cooling medium. The temperature rise could block the cooling flow of the magnetic pot by cavitation. The pot temperature rises quickly. The pot cracks by thermal stress.				2. Pump checks logged once per shift.					
			Recordable injury to person nearby is not likely because the chloroform is cold. Any material sprayed onto a person can be easily washed away in the safety shower.									
			No consequence.									
	1. Pump run dry (closed suction valve, or low level in Residue Treater.)	F	Temperature of the magnetic pot will rise due to no cooling. The pot can crack due to thermal stress.				1. Pump is in diked area.					
	2. Person present	VF	Recordable injury to person nearby is not likely because the chloroform is cold. Any material sprayed onto a person can be easily washed				2. Pump checks logged once per shift.					

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Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
			away in the safety shower.									
11. Reverse Flow			No consequence.									
12. Error in Source			No consequence.									
12. Error in Destination			No consequence.									
13. High Composition			No consequence.									
14. Low Composition			No consequence.									
15. Other than / Contamination			No consequence.									
16. High / Low Viscosity			No consequence.									
17. High / Low pH			No consequence.									
18. More agitation			No consequence.									
19. Less / No agitation			No consequence.									
20. Utility Failure			No Consequence.									
21. Mechanical Failure			See low/no flow.									
22. Corrosion / Erosion			Teflon Lined. No consequence.									
23. Static Electricity			No consequence.									
24. Startup / Shutdown Hazards			See low/no flow.									
25. Maintenance Hazards			No consequence.									
26. Emergency Situation Hazards			No consequence.									
27. Adjacent Equipment Hazards			No consequence.									
28. Sampling Hazards			Sampling at this point is very rare. An evacuation box is installed for this sample.				1. Sampling procedure according SOP					
29. Personal Protection Hazards			No consequence.									
			No consequence.									

B03S-001286



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Code: 60. Chloroform Unloading into Fresh Tank C-240
Drawings: 817733-02B2 (R19)-Sheet 2 of 2

Deviation	Cause	f	Consequence	Potential Risk			Safeguards	N	Mitigated Risk			RS No.
				S	P	R			S	P	R	
High Pressure	1. Failure of nitrogen regulator allowing full pressure plant nitrogen into the rail car.	F	Pressure of plant nitrogen from header is 90 psig, which is not considered capable of rupturing the railcar.				1. PSV on Railcar can handle the nitrogen input. 2. PSV 240-51 set at 140 psig (on the transfer line) relieves into the chloroform storage tank recirculation line.					
2. Low Pressure			No Consequence									
3. Vacuum	1. Nitrogen regulator failure during unloading.	F	The chloroform vapor pressure limits the amount of vacuum that can be placed on the system. Chloroform vapor pressure at 20C is 200 mbar. The pumps would cavitate under vacuum conditions and stop emptying the railcar. At this level of vacuum, it is possible to suck in the railcar but it is not likely to leak chloroform. Financial consequence only.	M	1	2	1. Recommendation--Confirm-- Any vacuum relief on the car? Is the car rated for vacuum? [Recommendation]		M	1	2	199
4. High Level	1. Hose not blown clear. Liquid left in hose in error. 2. Disconnect hose.	F	Potential spillage of 2 - 3 gal chloroform on discharge - exposure and exceeds 10 pound Reptable Quantity.	M	1	2	1. Recommendation-- Confirm Barrier to keep chloroform from leaking directly to the soil. Update 2011 01-10: On HOLD per project. [Recommendation]		M	1	2	200
5. Low / No Level			No Consequence									
6. High Temperature			No Consequence									
7. Low Temperature			No Consequence									
8. High Flow	1. Transfer line left open for a period of time after liquid transfer complete.		Large rate of transfer of nitrogen saturated with chloroform vapor to VGI.				1. PI 240-2 will indicate pressure rise, but no alarm					
Low / No Flow			No consequence.									
Reverse Flow	1. Failure to clear transfer line with nitrogen.	F	If the transfer line is not cleared with nitrogen following unloading, The chloroform could flow back from the storage tank if the transfer valve is not closed. The storage tank could be emptied to the ground.	H	2	1	1. Four eyes principle per SOP--Two Distribution specialists required. Close valve at storage tank and unloading hose.	1.0	H	3	2	212

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